SECTION I

Executive Summary

Introduction

The American Association of State Highway and Transportation Officials's (AASHTO's) Strategic Highway Safety Plan identified 22 goals to pursue in order to significantly reduce highway crash fatalities. One of the plan's hallmarks is to comprehensively approach safety problems. The range of strategies available in the guides will ultimately cover various aspects of the road user, the highway, the vehicle, the environment, and the management system. The guides strongly encourage the user to develop a program to tackle a particular emphasis area from each perspective in a coordinated manner. To facilitate this, the electronic form of the material uses hypertext links to enable seamless integration of various approaches to a given problem. As more guides are developed for other emphasis areas, the extent and usefulness of this integration will become ever more apparent.

AASHTO's overall goal is to move away from *independent* activities of engineers, law enforcement, educators, judges, and other highway safety specialists and to move toward *coordinated* efforts. The implementation process outlined in the series of guides promotes forming working groups and alliances that represent all of the elements of the safety system. In so doing, they can use their combined expertise to reach the bottom-line goal of targeted reduction of crashes and fatalities associated with a particular emphasis area.

Goal 6 in the Strategic Highway Safety Plan is *Keeping Drivers Alert*. For the purposes of this guide, the focus is on inattentive driving due to distraction or fatigue. The identified objectives and strategies are aimed at both decreasing the occurrence of distracted or fatigued driving, and making the consequences of lapses of attention less severe.

Objectives of the Emphasis Area

The objectives for reducing crashes and crash-related injuries and deaths due to inattentive driving are to

- Make roadways safer for fatigued or distracted drivers,
- Provide safe stopping areas,
- Increase awareness of the dangers of drowsy/distracted driving in the general driving population and promote driver focus, and
- Implement programs that target subpopulations at increased risk of distracted and drowsy driving.

The first objective draws heavily from two earlier guides: Volume 6 addressing run-off-road collisions and Volume 4 addressing head-on collisions. The second objective also targets the road environment but from a different perspective – seeking to prevent a crash from occurring in the first place. The third objective is directed at the general driving population, whereas the fourth targets subpopulations known to be at increased risk of involvement in distracted or drowsy driving crashes. These high risk populations include young drivers, drivers who work nighttimes or have irregular work schedules, commercial vehicle operators, persons with undiagnosed sleep disorders, and others.

For each objective, one or more specific strategies are identified. The strategies are intended for implementation by state DOTs, highway safety offices, motor vehicle departments, law enforcement agencies, and others.

Explanation of Objectives

Text to be added

EXHIBIT I-1
Emphasis Area Objectives and Strategies

Objectives	Strategies
Objective X.1A – Make roadways safer for drowsy or distracted drivers	Strategy X.1 A1 – Install shoulder and/or centerline rumble strips (P)
	Strategy X.1 A2 – Implement other roadway improvements to reduce the likelihood and severity of run-off-road and/or head-on collisions (P)
Objective X.1 B – Provide safe stopping areas on interstates and other roadways	Strategy X.1 B1 – Improve rest area availability, access, and services (E)
Objective X.1 C – Increase driver awareness of the risks of drowsy/distracted driving and promote driver focus	Strategy X.1 C1 – Conduct education and awareness campaigns targeting the general driving public (E)
	Strategy X.1 C2 – Enact legislation enabling prosecution of drivers causing crashes due to serious and willful distraction or fatigue (T)
Objective X.1 D – Implement programs that target populations at increased risk of distracted/drowsy crashes	Strategy X.1 D1 – Strengthen graduated driver licensing requirements for young novice drivers (P)
	Strategy X.1 D2 – Incorporate information on distracted/fatigued driving into education programs and materials for young drivers (E)
	Strategy X.1 D3 – Encourage employers to offer fatigue management programs to employees working nighttime or rotating shifts (P)
	Strategy X.1 D4 – Require trucking companies to implement fatigue management programs (P)
	Strategy X.1 D5 – Monitor and support commercial motor vehicle hours of service regulations (E)
	Strategy X.1 D6 – Implement targeted education campaigns for other high risk populations (T)

* An explanation of (P), (T) and (E) appears on page V-3.

Target of the Objectives

The first objective addresses changes to the roadway that either reduce the likelihood that an inattentive driver will crash, or that reduce the likely severity of inattention crashes once they do occur. This objective is most pertinent for state and local DOT engineers. The second object addresses changes in the broader driving environment, and specifically aims to reduce the occurrence of crashes due to driver inattention by providing safe places for drivers to stop and take a break from driving. While DOT planners are the primary target group for implementing this strategy, engineers, law enforcement, and highway safety officials can also contribute to its success.

The third objective focuses on the general driving population. Since distracted and fatigued driving are primarily behavioral issues, it is generally believed that educating drivers, and working to create a change in public opinions and attitudes towards drowsy and distracted drivers, is key to reducing these types of crashes. Finally, the fourth objective addresses specific subpopulations known to be at increased risk of drowsy and distracted driving crashes. Each has specific characteristics and needs that require more intensive individualized efforts to bring about the desired changes in behavior that will lower crash risk. Implementing educational interventions requires broad input and support from the highway safety community and draws upon both public and private resources.

SECTION II

Introduction

[Forthcoming.]

SECTION III

Type of Problem Being Addressed

General Description of the Problem

The National Highway Traffic Safety Administration (NHTSA) has identified driver inattention as a causative factor in 25-30 percent of crashes (Wang, Knipling and Goodman, 1996). An inattentive driver may be temporarily distracted by something inside or outside the vehicle, may be drowsy or fatigued, or may simply be "lost in thought." Crashes involving drivers who have fallen asleep at the wheel are especially likely to result in serious or fatal injuries. Helping drivers maintain alertness – and making the consequences of a lapse in alertness less severe – can lead to significant reductions in highway-related fatalities and injuries.

Driver distraction is typically defined in terms of an object or event drawing one's attention from the driving task. It is this presence of a triggering event that distinguishes a distracted driver from one who is simply inattentive or "lost in thought." The research literature identifies four ways in which drivers may be distracted while driving (REF). They can be distracted **visually**, for example, when they look away from the roadway to locate a CD or tend to a crying baby. They can also be distracted **audibly**, for example, by a honking car or by children fighting in the back seat of the car. When drivers manipulate radio controls, reach to open the glove compartment, or dial a cell phone number, they are being **physically** distracted from the driving task. And finally, when they engage in a conversation, whether with a passenger or with the person on the other end of a cell phone connection, they are in danger of being distracted **cognitively**. Cell phone use, an activity that has garnered considerable attention from the highway safety community, the media, and state and local lawmakers, has the potential for distracting drivers in all four of these areas. It also represents the "tip of the iceberg" in terms of wireless technologies increasingly available in new vehicles.

Unlike driver distraction, driver drowsiness or fatigue involves no triggering event, but instead is characterized by a progressive withdrawal of attention from the road and traffic demands (REF?). Drowsiness is the inevitable result of inadequate sleep. Fatigue, on the other hand, can occur even in rested drivers who may be physically tired from hard work or stress, or who may have been driving for a prolonged period of time. For both drowsy and fatigued drivers, however, the effects are the same: a decrease in driving performance and increased risk of crash involvement. For the purposes of this report, the terms "drowsy" and "fatigued" are used interchangeably, and also include the ultimate level of drowsiness of falling asleep at the wheel.

Both distracted and fatigued driver crashes are thought to be underreported, since evidence of driver distraction or fatigue may not be evident at the scene of a crash, and since drivers may be reluctant to admit distraction or fatigue if they believe it will increase their likelihood of being charged in a crash. Although most state crash report forms contain a code for identifying drowsy and/or fatigued drivers, only 17states collect information on

the role of distraction in traffic crashes, and many of these identify only a few major sources of distraction such as cell phone use (Sundeen, 2003).

In June 2003, the Governors' Highway Safety Association released a second edition of the Model Minimum Uniform Crash Criteria (MMUCC, 2003). The publication recommended the addition of a new data element to state crash report forms to collect information on driver distraction at the time of the crash. Recommended codes included not distracted, electronic communication devices (cell phone, pager), other electronic devices (navigation device, palm pilot, etc.), other inside the vehicle, other outside the vehicle and unknown. The addition of this data element was deemed to important for documenting emerging highway safety issues. However, there is still a need for increased training of law enforcement in identifying distraction and fatigue as contributing factors to crashes.

In the absence of definitive crash data, there is ample evidence of the prevalence of driver distraction and fatigue and its importance for driving safety from survey data. According to the National Sleep Foundation's annual Sleep in America survey, one in five drivers reports having fallen asleep at the wheel in the past year (NSF, 2003). And according to recent NHTSA surveys conducted by The Gallup Organization, one in four drivers reports having been involved in a crash in the past five years, and of these, 14% attribute the crash to their being distracted and 3% attribute it to drowsy driving (Royal, 2003).

Specific Attributes of the Problem

The primary source of information on the role of driver distraction and fatigue in traffic crashes is the Crashworthiness Data System (CDS), a part of NHTSA's National Accident Sampling System[1]. The CDS collects detailed data on an annual probability sample of approximately 5,000 police-reported traffic crashes involving at least one passenger vehicle that has been towed from the crash scene. Trained professional crash investigation teams collect information at the scene of the crash, from an examination of the crash-involved vehicles, directly from interviews with the crash victims and other witnesses, and from available medical records. Beginning in 1995, a variable describing the attention status of the driver – Driver's Distraction/Inattention to Driving – was added to the data collection protocol.

A recent analysis of five years of CDS data, weighted to reflect all passenger car crashes in the U.S., revealed that 8.3% of drivers were distracted at the time of their crash, 1.8% were sleepy or asleep, and an additional 5.4% "looked but didn't see" (See Figure 1) (Stutts et al., 2001). These three categories together totaled 15.5% of crash-involved drivers. This total does not take into account the large percentage of cases (36%) where attention status was coded as unknown (this despite the in-depth nature of the crash investigation). If one assumes that these unknown cases are distributed like the known cases, then the percentage of distracted, sleepy, or otherwise inattentive drivers increases to 19.5%. This percentage applies to all crash-involved *drivers*. The percentage of *crashes* involving an inattentive

[1] Although NHTSA's Fatality Analysis Reporting System, or FARS data also records information on driver-related factors in fatal crashes, driver inattention is believed to be seriously underreported because it is not contained on most states' crash report forms. In 2002, 2.9% of drivers involved in fatal crashes were identified as asleep or fatigued, and 6.5% were identified as inattentive (NHTSA, 2004).

driver is still higher, since in multi-vehicle crashes it is frequently the case that only the at-fault driver is distracted or fatigued.

INSERT FIGURE 1 ABOUT HERE - pie chart

While younger drivers under the age of 20 are especially likely to be distracted at the time of their crash, all age groups are affected (see Table 1). Older drivers are less likely to be involved in drowsy driving crashes, but are overrepresented in "looked but didn't see" crashes, which are a form of driver inattention. Clearly no age group is immune to the problem.

EXHIBIT X-X
Distribution of driver attention status within categories of driver age based on weighted 1995-1999 CDS data (column percents and standard errors).

	Driver Age				
Driver Attention Status	**<20**	**20-29**	**30-49**	**50-64**	**65+**
Attentive	48.6 [1]	47.4	50.7	53.6	47.8
	(2.7) [2]	(2.9)	(2.8)	(5.1)	(3.9)
Distracted	11.7	7.6	8.0	7.5	7.9
	(1.9)	(0.7)	(0.9)	(0.8)	(1.4)
Looked but didn't see	5.4	4.6	4.2	4.4	16.5
	(0.7)	(1.2)	(1.0)	(0.9)	(2.8)
Sleepy or fell asleep	1.7	1.9	1.9	2.0	1.1
	(0.5)	(0.6)	(0.6)	(0.6)	(0.3)
Unknown / no driver	32.6	38.6	35.2	32.6	26.7
	(2.8)	(3.3)	(3.3)	(4.4)	(2.6)
OVERALL	16.9	29.9	35.4	9.9	7.8

[1] Percent of crashes
[2] Standard error

Overall, 10.2% of drivers on the weighted 1995-1999 CDS data experienced serious or fatal injuries. For drivers identified as distracted at the time of their crash, this percentage was somewhat lower at 7.9%. However, almost a third (29.3%) of drivers involved in drowsy driving crashes were seriously or fatally injured (see Figure 2). NHTSA has estimated that drowsy driving is responsible for at least 1,500 deaths per year (Knipling and Wang, 1994; Knipling and Wang, 1995).

INSERT FIGURE 2 ABOUT HERE - From table 13

Information on how the attention status of crash-involved drivers varies for different roadway conditions is summarized in Table 2. Here, the table reports the percentage of crashes of each type involving the specific roadway characteristics (more than two travel lanes, speed limit greater than 45 mph, etc.). Compared to drivers judged to be attentive, those identified as distracted at the time of their crash are less likely to be traveling on multi-lane roadways and less likely to crash at an intersection or other road junction. Drowsy drivers, on the other hand, are nearly twice as likely to crash on roadways with speed limits greater than 45 mph, and much *less* likely to crash at intersections. Interestingly, these results indicate that they are also somewhat less likely to crash on multi-lane roadways.

EXHIBIT X-X
Roadway effects on driver attention status based on weighted 1995-1999 CDS data.

Driver Attention Status	Percent of Crashes Involving:			
	>2 Lanes	Speed Limit >45 mph	Non-level Grade	Intersection/ Junction
Attentive	50.1 [1]	24.9	32.6	66.0
	(2.1) [2]	(3.0)	(3.0)	(1.9)
Distracted	37.1	20.2	36.4	50.4
	(3.7)	(2.8)	(5.9)	(2.8)
Looked but didn't see	41.1	15.1	22.3	88.3
	(2.6)	(2.8)	(4.2)	(3.4)
Sleepy or fell asleep	34.1	42.8	34.0	14.2
	(6.6)	(5.7)	(7.6)	(6.1)
Unknown / no driver	45.6	21.6	31.5	61.1
	(2.8)	(3.7)	(2.2)	(1.0)
OVERALL	46.6	23.1	32.0	63.2

[1] Percent of crashes
[2] Standard error

Finally, in a table similar to that above, Table 3 provides information on a variety of other crash-related factors, including light and weather conditions, type of vehicle, and number of occupants in the vehicle (see Table 3). Differences between distracted and attentive drivers across these variables are relatively small and are not statistically significant. However, drowsy drivers are significantly more likely to crash during non-daylight hours. They are also significantly less likely to crash under adverse weather conditions and to be carrying passengers in their vehicle.

EXHIBIT X-X
Crash characteristics effects on driver attention status based on weighted 1995-1999 CDS data.

Driver Attention Status	Percent of Crashes Involving:			
	2+ Vehicles	Veh. Going Straight	Front Impact	Serious+Fatal Driver Injury
Attentive	77.6 [1]	53.5	56.8	7.6
	(1.3) [2]	(1.0)	(1.4)	(3.3)
Distracted	57.0	55.3	74.6	7.9
	(5.3)	(4.7)	(2.7)	(2.9)
Looked but didn't see	96.4	36.0	48.4	6.8
	(1.5)	(4.8)	(7.7)	(2.7)
Sleepy or fell asleep	18.5	62.8	68.3	29.3
	(1.9)	(6.9)	(4.7)	(11.4)
Unknown / no driver	73.5	59.7	64.3	13.9
	(1.8)	(1.4)	(1.1)	(5.5)
OVERALL	74.4	55.1	61.4	10.2

[1] Percent of crashes
[2] Standard error

In addition to these results based on passenger vehicles, drowsy driving has also been identified as a problem for commercial vehicle operators, especially long haul truck drivers. This is primarily due to the increased mileage and more frequent nighttime driving associated with trucking, although extended driving times and irregular sleep schedules also play a role. An estimated 1% of all large truck crashes, 3-6% of fatal heavy truck crashes, and 15-33% of fatal to the truck occupant only crashes have been attributed to driver fatigue (Knipling and Shelton, 1999).

State Data

As noted above, states vary in the extent to which they collect data on the attention status of drivers involved in crashes. Whereas all but six states responding to a recent survey indicated that their crash report form includes a checkbox or category for identifying sleep- or fatigue-related crashes, not all forms include places for identifying both fall asleep and fatigue crashes: in some states only one of the categories is identified, and in others they are combined (NSF 1998 survey on website, but can maybe cite Drobnich).

While recent interest in cell phones and other technologies has spurred a number of states to modify their crash report forms to include more information on driver distractions and in particular cell phone use, the reliability of the resulting data has not been demonstrated. In its recent update on state legislative activities related to cell phone use, the National Conference of State Legislatures summarized published data from seven states (California, Florida, Michigan, Minnesota, Oklahoma, Pennsylvania, and Tennessee) regarding crashes attributed to driver inattention and driver cell phone use. The reported percentage of crashes involving inattention ranged from a low of 0.6% to a high of 29.9% (Sundeen, 2003), a clear indication of the difficulties in collecting reliable data on driver attention status at the time of a crash.

Neither the NASS General Estimates System (GES), based on a nationally representative probability sample of all police-reported crashes, nor FARS, based on a census of all reported fatal crashes, report state-level data on the prevalence of crashes due to driver inattention or fatigue.

References

Knipling, R.R. and T.T. and Shelton. Problem Size Assessment: Large Truck Crashes Related Primarily to Driver Fatigue," Proceedings of the Second International Large Truck Safety Symposium, EO1-2510-002-00, University of Tennessee Transportation Center, Knoxville, October 1999, pp. 3-12.

Knipling, R.R. and W.S. Wang. "Crashes and Fatalities Related to Driver Drowsiness/Fatigue, Research Note," U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, DC, 1994.

Knipling, R.R. and W.S. Wang. "Revised Estimates of the US Drowsy Driver Crash Problem Size Based on General Estimates System Case Reviews," *39th Annual Proceedings, Association for the Advancement of Automotive Medicine*, Chicago, IL, 1995, p.451-456.

_____. Model Minimum Uniform Crash Criteria Guideline, Second Edition, Governor's Highway Safety Association, Washington, D.C., 2003. [Available http://www.mmucc.us]

National Highway Traffic Safety Administration. Traffic Safety Facts 2002, U.S. Department of Transportation, NHTSA, Washington, D.C., January 2004. [Available at http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2002Final.pdf]

Royal, D. National Survey of Distracted and Drowsy Driving Attitudes and Behavior: 2002. Volume I: Findings Report, The Gallup Organization, Washington, DC, April 2003. [Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/survey-distractive03/index.htm]

Stutts, J.C., D.W. Reinfurt, L. Staplin and E.A. Rodgman. *The Role of Driving Distraction in Traffic Crashes*, AAA Foundation for Traffic Safety, Washington, D.C., 2001. [Available http://www.aaafoundation.org]

Wang, W.S. R.R. Knipling and M.J. Goodman. The Role of Driver Inattention in Crashes: New Statistics from the 1995 Crashworthiness Data System," 40th *Annual Proceedings, Association for the Advancement of Automotive Medicine*, Vancouver, British Columbia, October 1996, p.377-392.

SECTION IV

Index of Strategies by Implementation Timeframe and Relative Cost

Exhibit IV-1 provides a classification of the identified strategies according to the expected timeframe and relative cost for this emphasis area. In keeping with the overall goal of these guides, the strategies that have been identified are generally short term and low cost undertakings. The primary exceptions are those strategies involving roadway or environmental modifications (e.g., for adding paved shoulders or expanding rest areas). The range of costs will vary for the strategies, depending upon the specific intervention undertaken and factors such as the size of the target audience and the availability of suitable existing materials and programs. Implementation time frame will also vary for these same reasons, and may also depend upon policies and laws already in place. Placement in the table below is meant to reflect the most common application of the strategy.

EXHIBIT IV-1
Classification of Strategies According to Expected Timeframe and Relative Cost

		Relative Cost to Implement and Operate			
Timeframe for Implementation	**Strategy**	**Low**	**Moderate**	**Moderate to High**	**High**
Short (<1 year)	X.1 A1 – Install shoulder and/or centerline rumble strips		✓		
	X.1 D2 – Incorporate information on distracted/fatigued driving into education programs and materials for young drivers	✓			
	X.1 D3 – Encourage employers to offer fatigue management programs to employees working nighttime or rotating shifts		✓		
	X.1 D4 – Require trucking companies to implement fatigue management programs		✓		
Medium (1-2 years)	X.1 A2 – Implement other roadway improvements to reduce the likelihood and severity of run-off-road and/or head-on collisions			✓ *	
	X.1 B1 – Improve rest area availability, access, and services	(Cost as well as time frame depends on selected improvement)			
	X.1 C1 – Conduct education and awareness campaigns targeting the general driving public		✓		
	X.1 C2 – Enact legislation enabling prosecution of drivers causing crashes due to serious and willful distraction or fatigue	✓			
	X.1 D1 – Strengthen graduated driver licensing requirements for young novice drivers	✓			

EXHIBIT IV-1
Classification of Strategies According to Expected Timeframe and Relative Cost

		Relative Cost to Implement and Operate			
Timeframe for Implementation	**Strategy**	**Low**	**Moderate**	**Moderate to High**	**High**
	X.1 D5 – Monitor and support commercial motor vehicle hours of service regulations		✓		
	X.1 D6 – Implement targeted education campaigns for other high risk populations		✓		
Long (>2 years)	(No strategies identified				

* Cost depends on selected improvement. See related guides.

SECTION V

Description of Strategies

Objectives

The objectives for reducing crashes and crash-related injuries and deaths due to inattentive driving are to

- Make roadways safer for fatigued or distracted drivers,
- Provide safe stopping areas,
- Increase awareness of the dangers of drowsy/distracted driving in the general driving population and promote driver focus, and
- Implement programs that target subpopulations at increased risk of distracted and drowsy driving.

The first objective draws heavily from two earlier guides: Volume 6 addressing run-off-road collisions and Volume 4 addressing head-on collisions. The second objective also targets the road environment but from a different perspective – seeking to prevent a crash from occurring in the first place. The third objective is directed at the general driving population, whereas the fourth targets subpopulations known to be at increased risk of involvement in distracted or drowsy driving crashes. These high risk populations include young drivers, drivers who work nighttimes or have irregular work schedules, and commercial vehicle operators.

For each objective, one or more specific strategies are identified. The strategies are intended for implementation by state DOTs, highway safety offices, motor vehicle departments, law enforcement agencies, and others.

Exhibit V-1 summarizes the identified objectives and strategies.

Explanation of the Objectives

EXHIBIT V-1
Emphasis Area Objectives and Strategies

Objectives	Strategies
Objective X.1A – Make roadways safer for drowsy or distracted drivers	Strategy X.1 A1 – Install shoulder and/or centerline rumble strips (P)
	Strategy X.1 A2 – Implement other roadway improvements to reduce the likelihood and severity of run-off-road and/or head-on collisions (P)
Objective X.1 B – Provide safe stopping areas on interstates and other roadways	Strategy X.1 B1 – Improve rest area availability, access, and services (E)

EXHIBIT V-1
Emphasis Area Objectives and Strategies

Objectives	Strategies
Objective X.1 C – Increase driver awareness of the risks of drowsy/distracted driving and promote driver focus	Strategy X.1 C1 – Conduct education and awareness campaigns targeting the general driving public (E)
	Strategy X.1 C2 – Enact legislation enabling prosecution of drivers causing crashes due to serious and willful distraction or fatigue (T)
Objective X.1 D – Implement programs that target populations at increased risk of distracted/drowsy crashes	Strategy X.1 D1 – Strengthen graduated driver licensing requirements for young novice drivers (P)
	Strategy X.1 D2 – Incorporate information on distracted/fatigued driving into education programs and materials for young drivers (E)
	Strategy X.1 D3 – Encourage employers to offer fatigue management programs to employees working nighttime or rotating shifts (P)
	Strategy X.1 D4 – Require trucking companies to implement fatigue management programs (P?)
	Strategy X.1 D5 – Monitor and support commercial motor vehicle hours of service regulations (E?)
	Strategy X.1 D6 – Implement targeted education campaigns for other high risk populations (T)

Note: The following page explains (T), (E), and (P) demarcations.

Types of Strategies

The strategies in this guide were identified from a number of sources, including the literature, contact with state and local agencies throughout the United States, and federal programs. Some of the strategies are widely used, while others are primarily an experimental idea of a single individual or agency. Some have been subjected to well-designed evaluations to prove their effectiveness. However, it was found that many strategies, including some that are widely used, have not been adequately evaluated.

The implication of the widely varying experience with these strategies, as well as of the range of knowledge about their effectiveness, is that the reader should be prepared to exercise caution in many cases before adopting a particular strategy for implementation. To help the reader, the strategies have been classified into three types, each identified by a letter:

- Tried (T)—Those strategies that have been implemented in a number of locations and that may even be accepted as standards or standard approaches, but for which there have not been found valid evaluations. These strategies—while in frequent, or even general, use—should be applied with caution, carefully considering the attributes cited in the guide, and relating them to the specific conditions for which they are being considered. Implementation can proceed with some degree of assurance that there is not likely to be a negative impact on safety and very likely to be a positive one. It is intended that as the experiences of implementation of these strategies continues under the AASHTO Strategic Highway Safety Plan initiative, appropriate evaluations will be

conducted so that effectiveness information can be accumulated to provide better estimating power for the user and the strategy can be upgraded to a "proven" (P) one.

- Experimental (E)—Those strategies that have been suggested and that at least one agency has considered sufficiently promising to try on a small scale in at least one location. These strategies should only be considered after the others have proven not to be appropriate or feasible. Even where they are considered, their implementation should initially occur using a very controlled and limited pilot study that includes a properly designed evaluation component. Only after careful testing and evaluations show the strategy to be effective should broader implementation be considered. It is intended that as the experiences of such pilot tests are accumulated from various state and local agencies, the aggregate experience can be used to further detail the attributes of this type of strategy, so that it can be upgraded to a "proven" (P) one.
- Proven (P)—Those strategies that have been used in one or more locations, and for which properly designed evaluations have been conducted that show it to be effective. These strategies may be employed with a good degree of confidence, but any application can lead to results that vary significantly from those found in previous evaluations. The attributes of the strategies that are provided will help the user judge which strategy is the most appropriate for the particular situation.

Targeting the Objectives

(Not sure what to include here, or how this differs from what was included in Section I)

Related Strategies for Creating a Truly Comprehensive Approach

The strategies listed above and described in detail below are those considered unique to this emphasis area. However, to create a truly comprehensive approach to the highway safety problems associated with this emphasis area, five types of related strategies should be included as candidates in any program planning process:

- Public Information and Education (PI&E) Programs—Many highway safety programs can be effectively enhanced with a properly designed PI&E campaign. The traditional emphasis with PI&E campaigns in highway safety is to reach an audience across an entire jurisdiction or a significant part of it. However, there may be a reason to focus a PI&E campaign on a location-specific problem. While this is a relatively untried approach, as compared with areawide campaigns, use of roadside signs and other experimental methods may be tried on a pilot basis.

  Within this guide, where the application of PI&E campaigns is deemed appropriate, it is usually in support of some other strategy. In such a case, the description for that strategy will suggest this possibility (see the attribute area for each strategy entitled "Associated Needs"). In some cases, specialized PI&E campaigns are deemed unique for the emphasis area and are detailed in the guide. In the future, additional guides may exclusively address the details regarding PI&E strategy design and implementation.

- Enforcement of Traffic Laws—Well-designed and -operated law enforcement programs can have a significant effect on highway safety. It is well established, for instance, that an effective way to reduce crashes (and their severity) is to have jurisdictionwide programs that enforce an effective law against driving under the influence (DUI) or driving without seat belts. When that law is vigorously enforced with well-trained officers, the frequency and severity of highway crashes can be significantly reduced. This should be an important element in any comprehensive highway safety program.

  Enforcement programs, by nature, are conducted at specific locations. The effect (e.g., lower speeds, greater use of seat belts, and reduced impaired driving) may occur at or near the specific location where the enforcement is applied. This effect can often be enhanced by coordinating the effort with an appropriate PI&E program. However, in many cases (e.g., speeding and seat belt usage), the impact is areawide or jurisdictionwide. The effect can be either positive (i.e., the desired reductions occur over a greater part of the system) or negative (i.e., the problem moves to another location as road users move to new routes where enforcement is not applied). Where it is not clear how the enforcement effort may impact behavior, or where an innovative and untried method could be used, a pilot program is recommended. Within this guide, where the application of enforcement programs is deemed appropriate, it is often in support of some other strategy. Many of those strategies may be targeted at either a whole system or a specific location. In such cases, the description for that strategy will suggest this possibility (see the attribute area for each strategy entitled "Associated Needs for, or Relation to, Support Services"). In some cases, where an enforcement program is deemed unique for the emphasis area, the strategy will be detailed. As additional guides are completed, they may detail the design and implementation of enforcement strategies.

- Strategies to Improve Emergency Medical and Trauma System Services—Treatment of injured parties at highway crashes can significantly impact the level of severity and length of time during which an individual spends treatment. This is especially true when it comes to timely and appropriate treatment of severely injured persons. Thus, a basic part of a highway safety infrastructure is a well-based and comprehensive emergency care program. While the types of strategies included here are often thought of as simply support services, they can be critical to the success of a comprehensive highway safety program. Therefore, an effort should be made to determine if there are improvements that can be made to this aspect of the system, especially for programs focused upon location-specific (e.g., corridors) or area-specific (e.g., rural areas) issues. Additional guides may detail the design and implementation of emergency medical system strategies.

- Strategies Directed at Improving the Safety Management System—The management of the highway safety system is foundational to success. There should be a sound organizational structure, as well as infrastructure of laws, policies, etc., to monitor, control, direct, and administer a comprehensive approach to highway safety. A comprehensive program should not be limited to one jurisdiction, such as a state department of transportation (DOT). Local agencies often must deal with most of the road system and its related safety problems and are more familiar with their problems. Additional guides may detail the design and implementation of strategies for improving safety management systems.

- Strategies that Are Detailed in Other Emphasis Area Guides—Any program targeted at the safety problem covered in this emphasis area should be created having given due consideration to the inclusion of other applicable strategies covered in the following guides:
  - Volume 4: A Guide for Addressing Head on Collisions
  - Volume 6: A Guide for Addressing Run-Off-Road Collisions

Objective 15.1 A—Make Roadways Safer for Drowsy or Distracted Drivers

Strategy 15.1 A1—Install Shoulder and/or Centerline Rumble Strips

General Description

Rumble strips are a proven treatment for reducing crashes caused by drowsy or distracted drivers. When placed along roadside shoulders, they alert drivers when they are about to run off the roadway, and when placed along centerlines, they alert them when they have inadvertently crossed into an opposing travel lane. Both treatments have been described in earlier guides: shoulder rumble strips in the guide for addressing run-off-road collisions (Volume 6), and centerline rumble strips in the guide for addressing head-on collisions (Volume 4).

Rumble strips are raised or grooved patterns placed in the paved surface of a roadway that produce both noise and vibration when a vehicle's tires travel across them. There are four basic types of rumble strips: rolled, milled, formed, and raised. Most shoulder varieties are grooved patterns that are either rolled into the hot pavement during initial road construction or resurfacing, or milled (cut) into an existing shoulder. Whereas earlier rumble strips were generally of the rolled variety, milled strips have become more common because of their greater flexibility and ease of installation. Shoulder rumble strips can vary across any number of dimensions, including the length and width of the groove, spacing between grooves, and distance that the grooves are offset from the edge of the roadway. Generally, however, the milled variety are about 0.5 inch deep, 5-7 inches wide, spaced 12 inches apart, and offset 4-18 inches from the edge of the roadway (see Exhibit). Rolled rumble strips tend to be both deeper and wider, and may be offset further from the roadway (Morgan and McAuliffe, 1997).

The first shoulder rumble strips were installed on the Garden State Parkway in New Jersey in 1955 (Harwood, 1993). Today, most states have adopted policies that require or encourage their use on rural interstates and interstate-like roadways. In addition, they are becoming increasingly used on rural two-lane roadways. In these situations, where wide paved shoulders are often lacking, states have been experimenting with "edgeline" shoulder rumble strips (link to Strategy 15.1 A2).

Another application of rumble strips is along the centerline of two-lane roads. As described in the guide for reducing head-on collisions (link to Strategy 18.1 A1), centerline rumble strips vary in design, but generally straddle the centerline and extend 5 inches to 1.5 feet into the travel lane. Although they were designated as "tried but unproven" in the earlier guide, a recent study carried out by the Insurance Institute for Highway Safety showed that the centerline rumble strips decreased head-on and opposing-direction sideswipe crashes on rural two-lane roads by 21 percent, and injury crashes by 25 percent. The study compared crash rates on 210 miles of roadway in seven states (CA, CO, DE, MD, MN, OK and WA) where centerline rumble strips had been installed, with comparable untreated roadway sections (Persaud et al, 2004).

The Federal Highway Administration maintains a website providing up-to-date information on a variety of issues surrounding shoulder and centerline rumble strips. The website can be accessed at http://safety.fhwa.dot.gov/programs/rumble.htm.

Exhibit V-1 (Strategy Attributes Table)
Link to 15.1 A1 (Shoulder Rumble Strips); 15.1 A2 (Rumble Strips for Roads with Narrow or Unpaved Shoulders; and 18.1 A1 (Centerline Rumble Strips for Two-Lane Roads)

Key References

Harwood, D.W. *Use of Rumble Strips to Enhance Safety*, NCHRP Synthesis 191, Transportation Research Board, National Research Council, Washington, D.C., 1993.

Morgan, A.L. and D.E. McAuliffe. *Effectiveness of Shoulder Rumble Strips: A Survey of Current Practice*, Special Report 127, New York State Department of Transportation, Albany, 1997.

Persaud, B.N., R.A. Retting and C. Lyon. *Crash Reductions Following Installation of Centerline Rumble Strips on Rural Two-Lane Roadways*, Insurance Institute for Highway Safety, Arlington, VA, 2003.

Stutts, J.C. *Sleep Deprivation Countermeasures for Motorist Safety*. NCHRP Synthesis 287, Transportation Research Board, National Research Council, Washington, D.C., 2000.

Information on Agencies or Organizations Currently Implementing this Strategy

To be completed.

Note the following study did not show effectiveness of rolled RS for drowsy driving crashes:
Griffith, M.S. *Safety Evaluation of Rolled-In Continuous Shoulder Rumble Strips Installed on Freeways*. Transportation Research Board, Washington, DC, 2000. Summary available on the web at http://safety.fhwa.dot.gov/fourthlevel/pdf/00-032.pdf

Pull from resources on FHWA website: http://safety.fhwa.dot.gov/programs/rumble.htm

Strategy X.1 A2—Implement Other Roadway Improvements to Reduce the Likelihood and Severity of Run-Off-Road or Head-On Collisions

General Description

Drowsy driving crashes typically involve a single vehicle traveling on a higher speed roadway departing the roadway (NCSDR/NHTSA, 1998). Most often the vehicle runs off the right side of the roadway. It is possible that left-side departures occur with equal frequency, but are less likely to result in a collision because, in the absence of oncoming traffic, the opposing travel lane allows greater opportunity for recovery. In either case, it is clear that roadway improvements which reduce the likelihood and/or severity of run-off-road and/or head-on collisions will also reduce many crashes caused by drowsy driving.

Less is known about crashes due to driver distraction, in part because there is less available data for studying these crashes, but also because there are many different sources of driver distraction contributing to a wider variety of crash types. Cell phone crashes, for example, are especially likely to occur at urban intersections; however, these are generally less serious "rear-end"crashes (Huang, Stutts and Hunter, 2003). Overall, crashes involving distracted drivers are also somewhat more likely to involve a single vehicle (Stutts et al., 2001; any other available data?)

Given these characteristics, many of the objectives and strategies identified in the run-off-road and head-on guides can effectively reduce the likelihood or severity of crashes due to drowsy or distracted driving. These include:

- The application of shoulder treatments that keep vehicles from encroaching on the roadside, such as eliminating shoulder drop-offs and widening and paving shoulders (link to 15.1 A8);
- Strategies to minimize overturning in the event a vehicle does run off the road, including designing safer slopes and ditches (link to 15.1 B1) and removing or relocating objects in hazardous locations (link to 15.1.B2);
- Strategies to reduce the severity of run-off-road crashes, including improved design of roadside hardware (link to 15.1 C1) and improved design and application of barrier and attenuation systems (link to 15.1 C2)
- Providing wider cross sections on two-lane roads (a relatively costly option) (link to 18.1 A4) and reallocating total two lane roadway width to include a narrow "buffer median" (link to 18.1 A5) to reduce encroachments into opposing travel lanes.

In addition, the unsignalized intersection guide contains a number of strategies under the general objective of improving driver awareness of intersections as viewed from the intersection approach. One of the strategies is to "Call attention to the intersection by installing rumble strips on intersection approaches" (link to 17.1.E6), and another is to "Install flashing beacons at stop-controlled intersections" (link to 17.1.E11). Both could help to alert drowsy or distracted drivers approaching an unanticipated intersection.

Beyond these strategies, the Utah Department of Transportation is evaluating an approach to reduce drowsy driving crashes that combines engineering and education components. Rumble strips are being placed across travel lanes at predetermined intervals on several rural highways with high rates of drowsy driving crashes. The rumble strips are accompanied by warning signs before and after that alert drivers to the dangers of drowsy driving. Exhibit __shows a series of four warning signs currently being evaluated. The signs have been placed at approximately 1/3 mile intervals along (#sections or miles) of rural roadway. While still experimental, Utah officials are hopeful that the approach will reduce the high number of fatal crashes caused by driver fatigue (an estimated 11% of all fatal crashes in the state, and the majority of crashes on rural roads) (Tang, 2004).

A final strategy that is still in the experimental stage involves roadway and roadside design treatments intended to address the problem of highway hypnosis, e.g., roadside planting for interest and variation. Anything been tried here? Is there any evidence that this is a viable strategy?

Exhibit - Strategy Attributes Table
Repeat links to the other guides?

Key References

Huang, H.F., J.C. Stutts and W.W. Hunter. "Characteristics of Cell Phone-Related Motor Vehicle Crashes in North Carolina," Transportation Research Record 1843, Transportation Research Board, Washington, DC, 2003.

National Center for Sleep Disorders Research. *Drowsy Driving and Automobile Crashes*, NCSDR/NHTSA Expert Panel on Driver Fatigue and Sleepiness, National Highway Traffic Safety Administration, Washington, DC, 1998. [Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/Drowsy.html]

Tang, P. Personal communication, April 2003.

Information on Agencies or Organizations Currently Implementing this Strategy

To be completed

Objective 15.1 A—Provide Safe Stopping Areas on Interstates and Other Roadways

Strategy 15.1 A1—Improve Rest Area Availability, Access and Services

General Description

The importance of rest areas for reducing fatigue-related crashes for truck drivers was a key objective in the Guide for Addressing Crashes Involving Heavy Trucks (link to Objective 12.1 A). Strategy 12.1 A1 (link) describes the need to increase efficiency of use of existing parking spaces, and Strategy 12.1 A2 (link) describes the need to create additional parking spaces for heavy trucks. But rest areas are also important for safe motor vehicle operation. The California Department of Transportation (Caltrans) web site notes that "Rest areas provide opportunities for motorists to safely stop, stretch, take a nap, use the restroom, get water, check maps, place telephone calls, switch drivers, check vehicles and loads, and exercise pets. Rest areas reduce drowsy and distracted driving and provide a safe and convenient alternative to unsafe parking along the roadside" (Caltrans, 2004).

A study by the Trucking Research Institute completed in 1996 found that nighttime truck parking was either full or overflowing onto the ramps in nearly 8 of 10 rest areas (TTI, 1996). In 1995 Congress passed legislation providing full federal funding for rest area construction and modification. Subsequently, an FHWA Report to Congress concluded that truck and bus parking was adequate when both public and private (commercial) facilities are considered (FHWA, 2002). In general, commercial vehicle operators prefer public rest area facilities for shorter stops and commercial truck stops for overnight parking. To expand commercial vehicle parking and lower costs, some states have explored partnerships with the private sector to construct commercial truck stops or travel-plazas (link to California, other good examples). In addition, the majority of states now allow truck drivers to stop at weigh stations when not in use, with some even providing added amenities such as restroom facilities and vending machines (FHWA 1998 ref.? also link to PennDOT as a case study)

Studies have generally not revealed a shortage of rest area parking for motor vehicle operators. However, there may be another problem – that of persuading motorists to stop and take a break from driving when they are feeling distracted or drowsy. Surveys have revealed that many motorists are reluctant to use rest areas because of concerns for personal safety (Fact Finders, Inc., 1994; Euritt et al., 1992; King, 1989). Two-thirds of the respondents to a survey of licensed drivers in New York State said that they would be very likely to stop at a rest area if they felt drowsy while driving; however, less than 30 percent said they would do so if driving alone at night, and for females, this percentage declined to just 17 percent (Fact Finders, Inc.). Similar results were reported in an earlier study of motorists in Texas (Euritt et al., 1992). To address these problems, the Rest Area Team for the New York State Task Force on Drowsy Driving recommended the following:

- Establishing State Police substations or satellite offices at key rest area locations;
- Installing security lighting;

- Providing direct telephone access to the police;
- Investigating the feasibility of security cameras where appropriate;
- Employing uniformed DOT maintenance personnel at each rest area, with 24-hour staffing at selected rest areas;
- Implementing design improvements, such as improved lighting and visibility from the roadway, to enhance rest area safety, security, and appearance.

In addition to being safe and secure, rest areas should be appealing to motorists, i.e, they should be clean, attractive, and provide basic amenities. To reduce drowsy driving crashes, they should ideally provide an opportunity for motorists to get a hot cup of coffee; but for rest areas located along interstates, only vending machines are typically available since federal law prohibits commercial operations on interstate right-of-ways. One option is to allow private nonprofit groups to dispense coffee, if not on a regular basis then during holidays or other peak travel periods (link to California program as an example). Another option again involves joining with the private sector to construct and/or operate rest area facilities off of the interstate right-of-way. The popularity of travel plazas along many toll roads and other private roadways attests to the importance of amenities for encouraging motorists to stop and take a break from driving.

Finally, rest areas should be available and accessible to motorists. FHWA guidelines recommend that facilities on interstates be located every 50 miles or one-hour driving time (FHWA, 1981). A 1989 NCHRP study estimated that the average spacing between rest areas on interstate highways nationwide was 44 miles and on primary roadways 31 miles. However, the average spacing of rest areas on interstates within individual states ranged from 25 to 105 miles (King, 1989). In addition, when a rest area is available, it is critical that motorists (including truck drivers) be allowed to use the facilities for sleeping or napping. Currently some states continue to impose length-of-stay restrictions that can discourage drowsy motorists from stopping at rest areas to sleep or nap (Stutts, 2000).

EXHIBIT V-X
Strategy Attributes for Improving Rest Area Availability, Access and Services

Technical Attributes
Target
Expected Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes

EXHIBIT V-X
Strategy Attributes for Improving Rest Area Availability, Access and Services

Organizational, Institutional and Policy Issues
Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References:

California Department of Transportation. Safety Roadside Rest Area System. Accessed April 27, 2004 at http://www.dot.ca.gov/hq/LandArch/rest-areas.htm.

Euritt, M.A., R. Harrison and S. Grant. *Feasibility of Safety Rest Area Commercialization in Texas*, Center for Transportation Research, University of Texas at Austin, 1992.

Fact Finders, Inc. *1994 Telephone Survey on Drowsy Driving: Summary Report*, Fact Finders, Inc. and Institute for Traffic Safety Management and Research, University at Albany, State University of New York, 1994.

Federal Highway Administration. *Report to Congress: Study of Adequacy of Parking Facilities*. Washington, D.C., June 2002.

Federal Highway Administration. 1981? Check for guidelines for rest area placement every 50 miles.

King, G.F. *Evaluation of Safety Roadside Rest Areas, NCHRP Program Report 324*, Transportation Research Board, National Research Council, Washington, D.C., 1989.

Stutts, J.C. *Sleep Deprivation Countermeasures for Motorist Safety. A Synthesis of Highway Practice*. NCHRP Synthesis 287, Transportation Research Board, National Research Council, Washington, D.C., 2000.

Information on Agencies or Organizations Currently Implementing this Strategy

To be completed.

Objective X.1 C—Increase Driver Awareness of the Risks of Drowsy/Distracted Driving and Promote Driver Focus

Strategy 15.1 A1—Conduct Education and Awareness Campaigns Targeting the General Driving Public

General Description

Education by itself will not immediately effect change in people's behavior. This is especially true if the educational intervention is an isolated event (a single TV public service announcement, a pamphlet in the mail), rather than a multi-faceted and sustained intervention over time. The latter can succeed in changing behavior if it alters the public mindset about what is acceptable and unacceptable behavior and creates new societal norms – in this case about driving while drowsy and driving while choosing to engage in other potentially distracting activities. In this sense, education is a necessary, but by no means sufficient, condition for reducing crashes resulting from driver inattention. Certainly legislative countermeasures require an educational component, but even roadway and environmental countermeasures such as rumble strips and rest areas incorporate educational components, e.g., to inform motorists of their purpose and persuade them to heed their warnings.

The goals of an educational campaign directed at reducing drowsy and/or distracted driving should be to increase public awareness of the problem, motivate a response (i.e., a change in behavior), and provide information on effective responses. For example, the National Sleep Foundation (NSF) annually releases results of its Sleep in America poll to the media highlighting the prevalence of sleepiness among U.S. adults and the consequences of falling asleep while driving. Its website and related materials also outline the warning signs for drowsy driving and let drivers know exactly what does and does not work to counteract drowsiness behind the wheel (link to website). Working with the National Highway Traffic Safety Administration, AAA Foundation for Traffic Safety and others, NSF conducts an ongoing (?) national public awareness campaign to reduce drowsy driving.

In the case of distracted driving, public education campaigns and materials have sometimes focused on the broad problem of driver inattention, or have been more narrowly focused on specific causes of driver inattention such as cell phones. Examples of the former include the AAA Foundation for Traffic Safety's "Pay Attention" campaign and the Network of Employers for Traffic Safety (NETS) "Who's Driving" campaign. Examples of the latter include efforts by the California Highway Patrol to educate drivers in that state about the dangers of cell phone use while driving (reference?), as well as PI&E efforts by individual insurance and cell phone companies. (Others good examples could link to?) Given the potential safety risk posed by widespread proliferation of wireless technologies other than cell phones (wireless internet, instant messaging, in-vehicle entertainment systems, etc.), consideration might also be given to influencing public attitudes and policies towards the use of these technologies while driving *before* they show themselves in crash data.

A message that has appeared in some recent efforts to educate the driving public about the dangers of inattentive driving equates drowsiness or talking on a cell phone with being

intoxicated. These messages derive from laboratory-based research comparing performance of sleep deprived subjects, or subjects engaged in conversations on a cell-phone, with that of subjects at various known blood alcohol levels. In the case of sleep deprived drivers, going without sleep for 17 hours has been equated to a BAC of .05, while going without sleep for 24 hours has been equated to a BAC of 0.10 – legally drunk in all states (Dawson and Reid, 1997). Recent British and U.S. studies have shown similar effects with regard to cell phone use while driving (Strayer et al., 2003; need a British reference if available. Only have news story for it.) While there are clearly physiological and practical differences between being drunk and being sleepy or being cognitively distracted by a cell phone conversation, these comparisons nevertheless send a powerful and readily comprehended message to the public about the potential dangers of these activities.

The above programs and activities target the general driving public. Education and awareness campaigns can also be developed that target specific subpopulations at increased risk. For example, NHTSA has developed a comprehensive drowsy driving program targeting shift workers and the American Trucking Associations has developed a program for truckers. These programs are discussed in a later section of this guide.

Finally, it should be noted that advocacy groups can play an important role in increasing public awareness of a problem and motivating action. Just as Mother's Against Drunk Driving (MADD) spearheaded a change in attitudes and behaviors surrounding drunk driving, Victims of Irresponsible Drowsy Driving (VOIDD), Parents Against Tired Truckers (PATT), and Advocates for Cell Phone Safety can be important partners in state and national efforts to curb drowsy and distracted driving.

EXHIBIT V-3
Strategy Attributes for

Technical Attributes	
Target	
Expected Effectiveness	By their nature, public information and education interventions are difficult to evaluate, and research is still needed to identify the most effective approaches for conveying information.
Keys to Success	
Potential Difficulties	
Appropriate Measures and Data	
Associated Needs	
Organizational and Institutional Attributes	
Organizational, Institutional and Policy Issues	
Issues Affecting Implementation Time	

EXHIBIT V-3
Strategy Attributes for

Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References

Dawson, D. and K. Reid. "Fatigue, Alcohol and Performance Impairment," *Nature*, Vol. 388, July 1997, p. 235.

Drobnich, D. and C.F. Murray. National Action Plan to Prevent Drowsy Driving, Washington, D.C., National Sleep Foundation, in press.

AAA Foundation for Traffic Safety. Pay Attention! (Available at http://www.aaafoundation.org/home/]

Strayer, D.L., F.A. Drews, and D.J.Crouch. "Fatal distraction? A Comparison of the Cell-phone Driver and the Drunk Driver. In D. V. McGehee, J. D. Lee, & M. Rizzo (Eds.) *Driving Assessment 2003: International Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design*. Published by the Public Policy Center, University of Iowa (pp. 25-30). [Available at http://www.psych.utah.edu/AppliedCognitionLab/DrivingAssessment2003.pdf]

Information on Agencies or Organizations Currently Implementing this Strategy

AAA Foundation for Traffic Safety
National Sleep Foundation
NHTSA
NETS Distracted Driver Tool Kit, plus decal, brochure, etc.
NETS Asleep at the Wheel? A Wake-UP Call for Drowsy Drivers

Strategy X.1 C2—Enact Legislation Enabling Prosecution of Drivers Causing Crashes Due to Serious and Willful Distraction or Fatigue

General Description

Note: Are we ready for this??? Should it be included??? Is there any evidence that it will have an impact??? Remember, we are telling states this is an effective strategy they should adopt.

Enactment of legislation prohibiting or restricting drivers from using cell phones or engaging in other potentially distracting activities while driving is a controversial topic. The National Conference of State Legislatures reports that since 1999 every state has considered legislation related to the use of wireless phones (Sundeen, 2003). However, no state currently bans talking on cell phones while driving, and only two states (New York and New Jersey) plus the District of Columbia prohibit use of hand-held phones. As of January 2004, 17 states have enacted legislation placing some level of restriction on cell phone use, most often by school bus drivers and a few for novice drivers (Sundeen, 2003; GHSA, 2004). In addition, 10 states considered legislation in 2003 directed at driving distractions beyond cell phone use (Sundeen, 2003).

To date, there is no evidence to show that such legislation reduces crashes. An evaluation of the New York State law, which went into effect November 2001, showed that following an initial decline in observed cell phone use, use rates in 2002 did not differ significantly from those in a control state without a law, and there had been no overall decline in cell phone-related crashes (McCartt and Geary, in press) The New Jersey law is likely to have even less of an effect, since it is a secondary rather than primary enforcement law.

Such laws can, however, send an important educational message to the driving public. In this case, the message is that talking on hand-held cell phones can be dangerous, increasing risk of injury to yourself as well as to other road users. However, current cell phone legislation may also be misleading, in that it may cause drivers to believe that use of a hands-free phone poses less of a risk than using a hand-held phone . In fact, studies have shown that hands-free phones are no safer than hand-held phones, because it is the cognitive distraction arising from the conversation itself that poses the greatest risk for driving (Strayer and Johnston, 2001; others). While laws directed more generally at prohibiting engagement in potentially distracting activities while driving can address this issue, they also suffer from difficulties in enforcement.

Rather than trying to legislate what drivers can and cannot do while driving, a more effective approach might be to send a clear message that drivers who choose to engage in potentially distracting activities while driving, or who choose to drive when drowsy or fatigued, will be held accountable for their decisions should they injure or kill someone in a crash. This is the approach New Jersey has taken in passing “Maggie’s Law,” a law that allows criminal prosecution of fatigued drivers who cause injury to some else. The law defines fatigue as being without sleep for a period of 24 hours or more, and allows prosecution under the state’s existing vehicular homicide statute pertaining to reckless driving.

Hasn't similar legislation been passed in some state with regard to distraction/cell phone use?

Although problems remain in crafting laws that are neither too broad nor too narrow, and that can be enforced by the judicial system, there appears to be strong public support for laws that can be effectively applied to prosecute the most serious instances of abuse. For less serious instances – the tired nightshift worker returning home in the morning, the driver who spills a cup of hot coffee – where public reaction is more generally of the nature "there but for the grace of God go I," such legislation can still play a role in shifting societal norms towards a greater appreciation of the importance of maintaining focus while driving.

EXHIBIT V-X
Strategy Attributes for Enact Legislation Empowering Prosecution

Technical Attributes
Target
Expected Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes
Organizational, Institutional and Policy Issues
Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References

Drobnich, D. and C.F. Murray. National Action Plan to Prevent Drowsy Driving, Washington, D.C., National Sleep Foundation, in press.

McCartt, A.T. and L.L. Geary. "Longer Term Effects of New York State's Law on Handheld Cell Phone Use," *Injury Prevention*, in press.

Governor's Highway Safety Association. Cell Phones and Highway Safety (website). http://www.naghsr.org/html/media_cellpage.html

Strayer, D.L. and W.A. Johnston. "Driven to Distraction: Dual-task Studies of Simulated Driving and Conversing on a Cellular Phone," *Psychological Science*, Vol. 12, 2001, p.462-466. [Available at http://www.psych.utah.edu/AppliedCognitionLab/PS-Reprint.pdf]

Sundeen, M. *Cell Phones and Highway Safety. 2003 State Legislative Update*. National Conference of State Legislatures, Denver, CO, December 2003. [Available at http://www.ncsl.org/programs/esnr/cellphoneupdate1203.htm]

Information on Agencies or Organizations Currently Implementing this Strategy

New Jersey law. Need to see if the following is the final version of the law: http://www.njleg.state.nj.us/2002/Bills/A1500/1347_R2.HTM

Objective X.1 D—Implement Programs That Target Populations at Increased Risk of Distracted/Drowsy Driving Crashes

Strategy X.1 D1—Strengthen Graduated Driver Licensing Requirements for Young Novice Drivers

General Description

In recent years all but a few U.S. states have adopted some form of graduated driver licensing (GDL) for young beginning drivers. Central to the GDL concept is a probationary license period between learner and full licensure stages, typically lasting from 6-12 months. During this period additional restrictions are placed on the teen's driving privilege. Most often these involve restrictions on unsupervised driving at nighttime and with other passengers in the vehicle. In addition, many states now require a certain number hours of supervised driving prior to full licensure.

The rationale behind GDL is that learning to drive is a high-risk venture, and teens need to be able to gain driving experience in as low-risk an environment as possible. Nighttime driving and driving with teen passengers both significantly increase a novice driver's likelihood of crashing. Nationally, forty-one percent of teenage motor vehicle deaths in 2002 occurred between 9 pm and 6 am (IIHS, 2003), and having two or more passengers in the car under the age of 21 has been shown to more than doubles a beginning driver's risk of crashing (McKnight and Peck, 2002; Foss and Goodwin,2003; IIHS, 2003) Both situations reflect an added layer of complexity and distraction to the driving task. Despite this evidence, only six states have nighttime driving restrictions starting before 11 pm, and only about half limit the number of teen passengers to two or fewer (IIHS, 2004).

Sleep experts point to another benefit of restricted nighttime driving for teens – namely, if teens are not allowed out at night, they are more likely to be at home, and perhaps also more likely to go to bed earlier and get more sleep (Drobnich, in press). This, in turn, leads to less daytime drowsiness and a reduced risk of a sleep-related crash. The earlier the restriction, the greater the potential benefit. Thus, a 9 pm curfew could be expected to contribute to greater daytime alertness than a midnight curfew.

The National Transportation Safety Board recently recommended an additional restriction on novice drivers: it recommended that drivers with learner's or provisional licenses be prohibited from using cell phones or other wireless communication devices while driving (NTSB, 2003). The rationale was the same as for other restrictions on a novice driver license – learning to drive is a challenging undertaking and needs to occur in as low-risk an environment as possible. Beginning drivers need to be able to direct their full attention to the task of driving, and not be distracted by trying to operate a cell phone and carry on a conversation. To date, two states, Maine and New Jersey, have enacted such legislation, and this number is expected to increase in the future.

In 2002, 5,178 teens died in motor vehicle crashes as either drivers or passengers of motor vehicles (IIHS, 2003). While the extent to which fatigue or inattention contributed to these crashes is not known, license restrictions that reduce the likelihood of distractions and promote increased attention to the driving task should help lower this number.

EXHIBIT V-3
Strategy Attributes for

Technical Attributes
Target
Expected Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes
Organizational, Institutional and Policy Issues
Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References

Drobnich, D. and C.F. Murray. National Action Plan to Prevent Drowsy Driving, Washington, D.C., National Sleep Foundation, in press.

Foss, R.D. and A.H. Goodwin. "Enhancing the Effectiveness of Graduated Driver Licensing Legislation," *Journal of Safety Research*. Vol. 34, No.1, 2003, p. 79-84. [Available at http://www.nsc.org/public/GDL/FossGoodwin.pdf]

Insurance Institute for Highway Safety. U.S. Licensing Systems for Young Drivers: Laws as of March 2004. Arlington, VA, IIHS, 2004.

Insurance Institute for Highway Safety. Fatality Facts - Teenagers 2002. Arlington, VA, IIHS, 2003.

McKnight, A.J. and R.C. Peck. "Graduated Driver Licensing: What Works?" *Injury Prevention* Vol. 8, Supplement II, (2002), p. ii32-ii36. [Available at http://ip.bmjjournals.com/cgi/reprint/8/suppl_2/ii32.pdf]

National Transportation Safety Board. "Ford Explorer Sport Collision With Ford Windstar Minivan and Jeep Grand Cherokee on Interstate 95/495 Near Largo, Maryland, February 1, 2002," Highway Accident Report NTSB/HAR-03/02. PB2003-916202 Notation 7561, National Transportation Safety Board, Washington, DC, 2003. {Available at **http://www.ntsb.gov/publictn/2003/HAR0302.pdf**]

Information on Agencies or Organizations Currently Implementing this Strategy

Strategy X.1 D2—Incorporate Information on Distracted/Fatigued Driving into Education Programs and Materials for Young Drivers

General Description

Young drivers are a high risk group for both distracted and drowsy driving crashes. When learning to drive, even small distractions such as tuning the radio or talking to a passenger can pose problems for teens. This is one reason why passenger restrictions for new drivers have been shown to have such a dramatic effect on crash involvement. An analysis of 1995-1999 national crash data showed the highest percentage of distracted driving crashes for drivers under the age of 20; leading the list of distractions were radios, tape and CD players; persons, objects or events outside the vehicle; and other occupants in the vehicle (Stutts et al., 2001). Teens and young adults are also more likely to own and use cell phones and other wireless technologies, such as voice mail and instant messaging, while driving (Royal, 2003; Stutts, Huang and Hunter, 2002).

In addition, young drivers are a high risk group for drowsy driving crashes. An analysis of national crash data revealed that nearly two-thirds of drivers in drowsy driving crashes were under the age of 30 (Knipling and Wang, 1995), and in an analysis of NC crash data, age 20 was the peak age for drivers involved in a sleep-related crash (Pack et al., 1995). An expert panel convened by NHTSA and the National Center for Sleep Disorders Research (NCSDR) recommended that educational efforts to reduce drowsy driving crashes be directed at young males ages 16-24 and shift workers (NCSDR/NHTSA, 1998). Subsequently, NCSDR hosted a workshop to develop strategies for best educating youth about sleep and drowsy driving (NCSDR, 1998), and the National Sleep Foundation prepared a report summarizing sleep-related issues affecting adolescents (NSF, 2000).

A starting point for educating youth about the dangers of both drowsy and distracted driving is to incorporate pertinent information into driver education and training programs. It has been estimated that half of all novice drivers participate in a formal driver education program NCSDR, 1998). The new model driver education curriculum developed jointly by NHTSA and the American Driver and Traffic Safety Education Association (ADTSEA) addresses both areas. States that provide for driver education for young novice drivers can require or encourage incorporation of appropriate material in all approved driver education programs, and can reinforce the message by including relevant questions on their driver license test.

Educational materials should also be made available through other venues such as websites, school health and safety classes, college orientations, and even military training programs. In addition, efforts should be directed towards parents, teachers, law enforcement, and others who have opportunities to influence young people's high risk driving behavior.

EXHIBIT V-3
Strategy Attributes for

Technical Attributes
Target
Expected

EXHIBIT V-3
Strategy Attributes for

Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes
Organizational, Institutional and Policy Issues
Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References

Knipling, R.R. and W.S. Wang. "Revised Estimates of the US Drowsy Driver Crash Problem Size Based on General Estimates System Case Reviews," *39th Annual Proceedings, Association for the Advancement of Automotive Medicine*, Chicago, IL, 1995, p.451-456.

National Center for Sleep Disorders Research. *Drowsy Driving and Automobile Crashes*, NCSDR/NHTSA Expert Panel on Driver Fatigue and Sleepiness, National Highway Traffic Safety Administration, Washington, DC, 1998. [Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/Drowsy.html]

National Center for Sleep Disorders Research. *Educating Youth about Sleep and Drowsy Driving: Strategy Development Workshop Report*. National Institutes of Health, National Heart, Lung, and Blood Institute, Washington, DC, September 1998.

National Sleep Foundation. Adolescent Sleep Needs and Patterns: research Report and Resource Guide. National Sleep Foundation, Washington, DC, 2000.

Pack, A.I., A.M. Pack, E. Rodgman, A. Cucchiara, D.F. Dinges and C. W. Schwab. "Characteristics of Crashes Attributed to the Driver Having Fallen Asleep," *Accident Analysis and Prevention*, Vol. 27, 1995, p.769-775.

Royal, D. National Survey of Distracted and Drowsy Driving Attitudes and Behavior: 2002. Volume I: Findings Report, The Gallup Organization, Washington, DC, April 2003. [Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/survey-distractive03/index.htm]

Stutts, J.C., H.F. Huang and W.W. Hunter. Cell Phone Use While Driving in North Carolina: 2002 Update Report. University of North Carolina, Highway Safety Research Center, Chapel Hill, NC, 2002.

Information on Agencies or Organizations Currently Implementing this Strategy

Could highlight the Change Drivers program

Could also include something on delayed school start times

Strategy X.1 D3—Encourage Employers to Offer Fatigue Management Programs to Employees Working Nighttime or Rotating Shifts

General Description

In 1996 Congress directed the National Highway Traffic Safety Administration to collaborate with the National Center on Sleep Disorders Research (NCSDR) to develop an educational program to reduce fatigue-related crashes. As part of their work, NHTSA convened an expert panel to review relevant literature, identify risk factors, identify population groups at highest risk, and recommend countermeasures for lowering their risk (NCSDR/NHTSA, 1998). Identified high risk populations included younger people ages 16-29, especially young males; shift workers whose sleep is disrupted by working at night or working long or irregular hours; and people with untreated sleep disorders. Subsequent focus groups with shift workers and their supervisors provided input to the development of a comprehensive workplace education program that includes a video, posters, brochures for workers and their families, tip cards, six brief PowerPoint training sessions, and a program administrator's guide (Link to NHTSA website with materials).

An estimated 21 million workers, or 20 percent of the workforce, engage in some form of shift work (NHTSA/NSF, 1998). Included are truck drivers, police officers, taxi drivers, transit operators, and others for whom driving is a part of their job. Many more shift workers are employed in industries, hospitals, and in service professions. For those working nighttime shifts, the trip home in the morning can be especially dangerous. An examination of the time of day distribution of drowsy driving crashes shows the expected nighttime and late afternoon peaks, corresponding to our bodies' two periods of greatest sleepiness. However, there is another smaller peak between 6 AM and 8 AM, which suggests

(Need to access some data on crashes to see if there is also an AM peak in percentage of crashes involving drowsy driving.)

Compared to non-shift workers, shift workers average only about five hours sleep a night, or about 1.5 hours less than non-shift workers; also, the sleep they do get is often fragmented and less restorative (Kessler, 1992; NHTSA/NSF, 1998). Persons with nighttime jobs are working against their natural biological clocks that cause them to be sleepiest in the middle of their work period, and most alert just when they get home and need to sleep. For those working rotating shifts, there may be little opportunity for their bodies to adjust to the changing wake/sleep schedules. A study involving interviews with drivers in sleep-related and non-sleep related crashes found that drivers working night shifts were six times more likely, and those working rotating shifts two times more likely, to have been involved in a sleep-related compared to non-sleep related crash (Stutts, Wilkins and Vaughn, 1999).

The workplace program developed by NHTSA and the National Sleep Foundation provides shift workers and their employers information on warning signs for dangerous drowsy driving, how to safely manage the commute home, tips for better sleep, and guidance for dealing with family members and friends. For employers, it provides detailed information on planning and implementing a workplace program In its evaluation of the program, NHTSA found workers to be highly receptive to the program's messages, and employers ------ (Need to locate any available evaluation report)

EXHIBIT V-3
Strategy Attributes for

Technical Attributes
Target
Expected Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes
Organizational, Institutional and Policy Issues
Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References

Kessler, E. *Shift Work: Family Impact and Employer Responses*, Special Report 32, Bureau of National Affairs, Washington, DC, 1992, p. 1-32.

National Highway Traffic Safety Administration. The NHTSA & NCSDR Program to Combat Drowsy Driving. Report to the House and Senate Appropriations Committees Describing Collaboration Between NHTSA and NCSDR, NHLBI, NIH. Available at [http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/drowsy2/drws-cov.htm]

National Highway Traffic Safety Administration. The Road to Preventing Drowsy Driving Among Shift Workers. Employer Administrator's Guide, Washington, D.C., National Sleep Foundation, 1998. {available at http://www.nhtsa.dot.gov/people/injury/drows_driving/index.html]

National Institute for Occupational Safety and Health. *Plain Language About Shiftwork*. NIOSH, Centers for Disease Control and Prevention, DHHS, July 1997. [Available at http://www.cdc.gov/niosh/pdfs/97-145.pdf]

Nelson, T.F., N.E.Isaac and J.D. Graham. Development and Testing of Countermeasures for Fatigue-Related Highway Crashes, Harvard School of Public Health, Boston, MA, 2001. {Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/listening/toc.htm]

Stutts, J.C., J.W. Wilkins and B.V. Vaughn. Why Do People Have Drowsy Driving Crashes? Input from Drivers Who Just Did. Washington, D.C., AAA Foundation for Traffic Safety, November 1999. [Report available at **www.aaafoundation.org**]

Information on Agencies or Organizations Currently Implementing this Strategy

NHTSA - Wake Up and Get Some Sleep Program
http://www.nhtsa.dot.gov/people/injury/drows_driving/index.html

National Sleep Foundation – Sleep Strategies for Shiftworkers.
http://www.sleepfoundation.org/publications/shiftworker.cfm

NIOSH Plain Language about Shiftwork

Need to locate other workplace programs

Strategy X.1 D4—Require Trucking Companies to Implement Fatigue Management Programs

General Description

In 2002 large trucks were involved in 434,000 crashes, resulting in nearly 4900 deaths and an estimated 130,000 injuries (NHTSA, 2003) (Note these numbers are slightly higher than what's on FMCSA website). An estimated 1% of all large truck crashes, 3-6% of fatal heavy truck crashes, and 15-33% of fatal to the truck occupant only crashes can be attributed to driver fatigue (Knipling and Shelton, 1999). A combination of long hours on the road, nighttime driving, and irregular work and sleep schedules combine to make fatigue an especially challenging problem for commercial vehicle drivers.

Since the early 1990s, commercial vehicle operator fatigue has been a top safety priority for government researchers as well as for the trucking industry. In 1990 the National Transportation Safety Board released the results of its study of fatal-to-the-driver large truck crashes, reporting that fatigue was the probable cause in 31% of the investigated crashes (NTSB, 1990). The Congressionally mandated Driver Fatigue and Alertness Study, completed by FHWA in 1996, provided first-time knowledge of drivers' alertness and performance levels and the factors that influence them (Wylie et al., 1996). Participants at the 1995 National Truck and Bus Safety Summit identified driver fatigue as the highest priority safety issue facing the industry; and more recently, "fatigue, alertness and distraction" was cited as one of five high-priority safety problem areas by the Federal Motor Carrier Safety Administration (FMCSA, 2002).

Created in 1999, the Federal Motor Carrier Safety Administration has continued FHWA's initiatives in carrying out a wide range of driver alertness and fatigue-related research and technology projects (see http://www.fmcsa.dot.gov/safetyprogs/fatigue for a summary). Currently it is collaborating with Transport Canada to develop a comprehensive North American Fatigue Management Program for Motor Carriers. Following pilot testing by two Canadian provinces and a U.S. motor carrier, the program will be revised and evaluated on a larger scale.

Once completed, it is likely that regulations will be promulgated that require trucking companies to implement comprehensive fatigue management programs (CHECK THIS OUT). Until this time, however, trucking fleets should be encouraged to voluntarily implement such programs. A recent synthesis entitled "Effective Commercial Truck and Bus Safety Management Techniques," sponsored by FMCSA, identified the following components of an effective fatigue management program:

- "Alertness friendly" scheduling that take sleep needs and circadian rhythms into consideration during dispatching, and also empowers drivers to adjust schedules, without discrimination, when needs dictate;
- Medical screening, counseling, and treatment for sleep disorders, in particular sleep apnea;
- Fatigue education, both for drivers and for carrier managers. (Knipling, Hickman and Bergoffen, 2003)

In the future, fatigue management programs might also incorporate a variety of fatigue management technologies, such as the actigraph ("sleep watch"), in-vehicle alertness monitoring and warning systems, and electronic on-board recorders for tracking on-duty status. Both FMCSA and NHTSA are actively pursuing the development of these and other technologies for reducing fatigue-related crashes and injuries (could link to a web document).

EXHIBIT V-3
Strategy Attributes for

Technical Attributes
Target
Expected Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes
Organizational, Institutional and Policy Issues
Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key references

Federal Motor Carrier Safety Administration, 2002 (Need to locate)

Knipling, R.R., J.S. Hickman and G. Bergoffen. *Effective Commercial Truck and Bus Safety Management Techniques,* Washington, D.C. Transportation Research Board, National Research Council, 2003.

Knipling, R.R. and T.T. Shelton. "Problem Size Assessment: Large Truck Crashes Related Primarily to Driver Fatigue," Proceedings of the Second International Large Truck Safety Symposium, EO1-2510-002-00, University of Tennessee Transportation Center, Knoxville, October 199, pp. 3-12.

National Highway Traffic Safety Administration. Traffic Safety Facts 2002, U.S. Department of Transportation, NHTSA, Washington, D.C., January 2004. [Available at http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2002Final.pdf]

National Transportation Safety Board. Safety Study: Fatigue, Alcohol, Other Drugs, and Medical Factors in Fatal-to-the-Driver Heavy Truck Crashes, Vol. 1, NTSB, Washington, D.C., 1990.

Wylie, C.D., T. Shultz, J.C. Miller, M.M. Mitler and R.R. Mackie. *Commercial Motor Vehicle Driver Fatigue and Alertness Study. Final Report* (Transport Canada Report TP 12875E) and *Technical Summary* (FHWA Report FHWA-MC-07-001), Essex Corporation, Goleta, CA, 1996.

Information on Agencies or Organizations Currently Implementing this Strategy

See Knipling et al report, pp.31 for sample programs and materials.

Strategy X.1 D5—Monitor and Support Commercial Motor Vehicle Hours of Service Regulations

General Description

In April 2003 the Federal Motor Carrier Safety Administration (FMCSA) implemented the first significant changes in hours of service (HOS) requirements for commercial motor vehicles since regulations were first adopted in 1939. The revised rulemaking had been recommended by the National Transportation Safety Board as part of a 1995 review of the Department of Transportation's efforts to address operator fatigue in all transportation modes, and from its own study of single-vehicle heavy truck crashes (Wylie et al., 1996).

The new HOS regulations increase the number hours that commercial vehicle operators can drive from 10 hours to 11, while also increasing the required number of off-duty hours from 8 hours to 10. The regulations also allow for a maximum of 14 hours on duty, following 10 (or more) hours off. After 34 or more consecutive off-duty hours, a driver may restart the 60-hour cap in a six day work week, or 70-hour cap in a seven day work week.

While hours of service regulations are deemed critical to safety within the trucking industry, research has shown compliance to be fragmented. FMCSA cites a recent survey revealing that 25% of drivers reported working 75 or more hours in the preceding seven days, and 10% reported working more than 90 hours (Freund, 1999; other references cited in Morrow and Crum, 2003). Increased enforcement, carried out as part of FMCSA's Compliance Reviews and Roadside Inspection programs, can help to increase operator and carrier compliance with HOS regulations.

States can also expand their support of such regulations in other important ways. One way is to offer training opportunities for compliance with DOT/FMCSA regulations. In North Carolina, the state Forestry Association sponsors six-hour workshops at local community colleges providing instruction and training to business owners and owner-operators in all aspects of DOT trucking requirements (link to Appendix). The workshop covers FMCSA regulations (including hours of service), driver qualification files, contents of driver cab files, and NC laws and permit information.

Offering trucking companies support in establishing comprehensive fatigue management programs (see strategy above) is another way to support the new hours of service regulations. In their responses to FMCSA's Notice of Proposed Rulemaking for revising HOS regulations, a number of commenters expressed interest "in developing a more holistic approach to the fatigue problem through the use of education and training programs, and screening for sleep apnea and other sleep disorders . . . usually mentioned in the context of fatigue management" (Federal Register, April 28, 2003, p.22460). While language to this effect was not incorporated into the final rulemaking, many organizations, including the National Sleep Foundation, continue to emphasize the necessity of a comprehensive and systematic approach to hours of service regulations (NSF, April 2003).

Finally, states can promote use of new technologies, both in monitoring compliance with HOS regulations and in assisting truck drivers in monitoring their own levels of alertness. With regard to the former, FMCSA opted not to require use of onboard recording devices and other electronic recordkeeping methods, even though doing so could significantly

increase compliance with regulations in place. ----- (Need update on FMCSA's activities in this area, whether pilot studies showed any increase in compliance, and whether rulemaking has been proposed allowing voluntary use of paperless log systems. Identified FMCSA contact is Neill Thomas, 202-366-4009. Also Bob Carroll, 202-385-2388)

Finally, over the past decade tremendous progress has been made in the development of technologies for monitoring and helping to maintain driver alertness. For example, there are systems currently available ---- (Again, need an update on NHTSA's R&D program in this area. Contact is Paul Rau, 202-366-0418)

EXHIBIT V-3
Strategy Attributes for

Technical Attributes
Target
Expected Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes
Organizational, Institutional and Policy Issues
Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References

Department of Transportation, Federal Motor Carrier Safety Administration. Hours of Service of Drivers; Driver Rest and Sleep for Safe Operations [Docket No. FMCSA-97-2350], Federal Register, Vol. 68, No. 81, April 28, 2003.

Freund, D.M. *An Annotated Literature Review Relating to Proposed Revisions to the Hours-of-Service Regulations for Commercial Motor Vehicle Drivers*, Office of Motor Carrier Safety (now FMCSA), Publication No. DOT-MC-99-129, November 1999. (Check – incrashes docket)

Morrow, P.C. and M.R. Crum. "Antecedents of Fatigue, Close Calls, and Crashes Among Commercial Motor-Vehicle Drivers," *Journal of Safety Research*, Vol. 35, 2004, pp.59-69.

National Sleep Foundation. NSF Statement Regarding New Hours of Service Rules for Truckers. News Archive 2003. Washington, DC, 2003. [Available at http://www.drowsydriving.org/press_room/news_stories/hosrules03.cfm]

Information on Agencies or Organizations Currently Implementing this Strategy

To be completed

Strategy 15.1 A1—Implement Targeted Education Campaigns for Other High-Risk Populations

General Description

There are a number of other groups at increased risk for involvement in inattention or fatigue-related crashes. They include individuals with untreated sleep disorders, law enforcement officers, military personnel, and medical residents. While some of these groups also fall into the category of shift workers, they each have unique characteristics that set them aside and that merit special intervention.

Along with young people and shift workers, persons with **untreated sleep disorders** were a third high risk group identified by the joint National Center for Sleep Disorders Research / National Highway Traffic Safety Administration Expert Panel on Driver Fatigue and Sleepiness (NCSDR, 1998). Specifically, the Panel was concerned about the documented high crash risks associated with sleep apnea and narcolepsy. Sleep apnea is a condition in which a person's airway collapses during sleep, causing temporary blockage of air into the lungs which then triggers an awakening response. The pattern can be repeated throughout the night, usually without the individual being aware of his awakenings. However, the resulting fragmented sleep can lead to extreme daytime sleepiness and a two- to seven-fold increase in the risk of motor vehicle crash involvement. An estimated 4-5 percent of men and 2 percent of women have undiagnosed sleep apnea (see Stutts, 2001; NCDSR, 1998).

Narcolepsy is a much less common, but potentially more serious condition in that with narcolepsy a person falls asleep with little or no warning, sometimes "napping" for 10-20 minutes. Although some states have adopted regulations and guidelines for drivers with narcolepsy as well as sleep apnea, a major drawback continues to be that the vast majority of these cases are not diagnosed. Two approaches that states might take to address this situation are (1) incorporate information on sleep disorders and their potential impact on driving safety in driver licensing handbooks and (2) work with the state's medical advisory board to help educate physicians in recognizing and diagnosing suspected sleep disorders.

A number of factors contribute to fatigue among **law enforcement officers**. These include irregular work hours, night work, overtime duties, "moonlighting," and the high stress that comes with the job. Although data on police involvement in fatigue-related crashes remains

mostly anecdotal, a recent study raises some alarming concerns (Vila, 2000). As part of the study, the author collected detailed information on officers' work hours and related accident and on-the-job injury data, as well as objective and perceived measures of sleepiness. The resulting book, *Tired Cops: The Prevalence and Potential Consequences of Police Fatigue* (Vilas, 2000) documents his findings and provides guidance for developing fatigue and alertness policies and programs for law enforcement agencies.

Recently, the AAA Foundation for Traffic Safety ---- (input from AAA)

Training law enforcement officers to better recognize and manage fatigue in their own lives may have the added benefit of encouraging them to be more conscientious in identifying and reporting fatigue-related motor vehicle crashes, and also to include fatigue and the risks of drowsy and inattentive driving when speaking to driver education classes and other audiences.

Other potential high risk populations:

Military personnel – motor vehicle crashes are the leading cause of death, accounting for between 30-40 percent of all non-combat deaths (Powell et al., 2004). As in other population subgroups dominated by young males, alcohol use and failure to wear seat belts are important factors in these deaths, but fatigue may also play a role. I don't have any firm data, however, and this may be too small a target group and one that can only directly be addressed by the military itself.

Medical residents – studies definitely show they're at high risk of crashing, but again, is this too small a group for this Guide to address?

EXHIBIT V-3
Strategy Attributes for

Technical Attributes
Target
Expected Effectiveness
Keys to Success
Potential Difficulties
Appropriate Measures and Data
Associated Needs
Organizational and Institutional Attributes
Organizational, Institutional and Policy Issues

EXHIBIT V-3
Strategy Attributes for

Issues Affecting Implementation Time
Costs Involved
Training and Other Personnel Needs
Legislative Needs
Other Key Attributes

Key References:

National Center for Sleep Disorders Research. *Drowsy Driving and Automobile Crashes*, NCSDR/NHTSA Expert Panel on Driver Fatigue and Sleepiness, National Highway Traffic Safety Administration, Washington, DC, 1998. [Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/Drowsy.html]

Powell, K.E., L.A. Fingerhut, C.M. Branche and D.M. Perrotta. "Deaths Due to Injury in the Military, *American Journal of Preventive Medicine*, Vol. 18(3S), 2000, pp. 26-32.

Vila, B. Tired Cops: The Importance of Managing Police Fatigue. Police Executive Research Forum, Washington, DC, 2000. [Information available at http://www.policeforum.org]

Information on Agencies or Organizations Currently Implementing this Strategy

SECTION VII

Key References

AAA Foundation for Traffic Safety. Pay Attention! Washington, DC, 2004 (Ordering information available at http://www.aaafoundation.org/]

California Department of Transportation. Safety Roadside Rest Area System. Accessed April 27, 2004 at http://www.dot.ca.gov/hq/LandArch/rest-areas.htm.

Dawson, D. and K. Reid. "Fatigue, Alcohol and Performance Impairment," *Nature*, Vol. 388, July 1997, p. 235.

Department of Transportation, Federal Motor Carrier Safety Administration. Hours of Service of Drivers; Driver Rest and Sleep for Safe Operations [Docket No. FMCSA-97-2350], Federal Register, Vol. 68, No. 81, April 28, 2003.

Drobnich, D. and C.F. Murray. National Action Plan to Prevent Drowsy Driving, Washington, D.C., National Sleep Foundation, in press.

Euritt, M.A., R. Harrison and S. Grant. *Feasibility of Safety Rest Area Commercialization in Texas*, Center for Transportation Research, University of Texas at Austin, 1992.

Fact Finders, Inc. *1994 Telephone Survey on Drowsy Driving: Summary Report*, Fact Finders, Inc. and Institute for Traffic Safety Management and Research, University at Albany, State University of New York, 1994.

Federal Highway Administration. *Report to Congress: Study of Adequacy of Parking Facilities*. Washington, D.C., June 2002.

Federal Highway Administration. 1981? Check for guidelines for rest area placement every 50 miles.

Federal Motor Carrier Safety Administration, 2002

Foss, R.D. and A.H. Goodwin. "Enhancing the Effectiveness of Graduated Driver Licensing Legislation," *Journal of Safety Research*. Vol. 34, No.1, 2003, p. 79-84. [Available at http://www.nsc.org/public/GDL/FossGoodwin.pdf]

Freund, D.M. *An Annotated Literature Review Relating to Proposed Revisions to the Hours-of-Service Regulations for Commercial Motor Vehicle Drivers*, Office of Motor Carrier Safety (now FMCSA), Publication No. DOT-MC-99-129, November 1999. (Check – in HOS docket)

Governor's Highway Safety Association. Cell Phones and Highway Safety (website). http://www.naghsr.org/html/media_cellpage.html

Huang, H.F., J.C. Stutts and W.W. Hunter. "Characteristics of Cell Phone-Related Motor Vehicle Crashes in North Carolina," Transportation Research Record 1843, Transportation Research Board, Washington, DC, 2003.

Insurance Institute for Highway Safety. U.S. Licensing Systems for Young Drivers: Laws as of March 2004. Arlington, VA, IIHS, 2004.

Insurance Institute for Highway Safety. Fatality Facts - Teenagers 2002. Arlington, VA, IIHS, 2003.

King, G.F. *Evaluation of Safety Roadside Rest Areas, NCHRP Program Report 324*, Transportation Research Board, National Research Council, Washington, D.C., 1989.

Knipling, R.R., J.S. Hickman and G. Bergoffen. *Effective Commercial Truck and Bus Safety Management Techniques,* Washington, D.C. Transportation Research Board, National Research Council, 2003.

Knipling, R.R. and T.T. Shelton. "Problem Size Assessment: Large Truck Crashes Related Primarily to Driver Fatigue," *Proceedings of the Second International Large Truck Safety Symposium,* EO1-2510-002-00, University of Tennessee Transportation Center, Knoxville, October 199, pp. 3-12.

Harwood, D.W. *Use of Rumble Strips to Enhance Safety*, NCHRP Synthesis 191, Transportation Research Board, National Research Council, Washington, D.C., 1993.

Kessler, E. *Shift Work: Family Impact and Employer Responses*, Special Report 32, Bureau of National Affairs, Washington, DC, 1992, p. 1-32.

Knipling, R.R. and W.S. Wang. "Crashes and Fatalities Related to Driver Drowsiness/Fatigue, Research Note," U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, DC, 1994. [1994 Research Notes not available on NHTSA website]

Knipling, R.R. and W.S. Wang. "Revised Estimates of the US Drowsy Driver Crash Problem Size Based on General Estimates System Case Reviews," *39th Annual Proceedings, Association for the Advancement of Automotive Medicine*, Chicago, IL, 1995, p.451-456.

McCartt, A.T. and L.L. Geary. "Longer Term Effects of New York State's Law on Handheld Cell Phone Use," *Injury Prevention*, in press.

McKnight, A.J. and R.C. Peck. "Graduated Driver Licensing: What Works?" *Injury Prevention* Vol. 8, Supplement II, (2002), p. ii32-ii36. [Available at http://ip.bmjjournals.com/cgi/reprint/8/suppl_2/ii32.pdf]

_____. Model Minimum Uniform Crash Criteria Guideline, Second Edition, Governor's Highway Safety Association, Washington, D.C., 2003. [Available http://www.mmucc.us]

Morgan, A.L. and D.E. McAuliffe. *Effectiveness of Shoulder Rumble Strips: A Survey of Current Practice*, Special Report 127, New York State Department of Transportation, Albany, 1997.

Morrow, P.C. and M.R. Crum. "Antecedents of Fatigue, Close Calls, and Crashes Among Commercial Motor-Vehicle Drivers," *Journal of Safety Research*, Vol. 35, 2004, pp.59-69.

National Center for Sleep Disorders Research. *Drowsy Driving and Automobile Crashes*, NCSDR/NHTSA Expert Panel on Driver Fatigue and Sleepiness, National Highway Traffic Safety Administration, Washington, DC, 1998. [Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/Drowsy.html]

National Center for Sleep Disorders Research. *Educating Youth about Sleep and Drowsy Driving: Strategy Development Workshop Report*. National Institutes of Health, National Heart, Lung, and Blood Institute, Washington, DC, September 1998.

National Highway Traffic Safety Administration. Traffic Safety Facts 2002, U.S. Department of Transportation, NHTSA, Washington, D.C., January 2004. [Available at http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2002Final.pdf]

National Highway Traffic Safety Administration. *The NHTSA & NCSDR Program to Combat Drowsy Driving. Report to the House and Senate Appropriations Committees Describing Collaboration Between NHTSA and NCSDR, NHLBI, NIH*. Available at [http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/drowsy2/drws-cov.htm]

National Highway Traffic Safety Administration. The Road to Preventing Drowsy Driving Among Shift Workers. Employer Administrator's Guide, Washington, D.C., National Sleep Foundation, 1998. {available at http://www.nhtsa.dot.gov/people/injury/drows_driving/index.html]

National Institute for Occupational Safety and Health. *Plain Language About Shiftwork*. NIOSH, Centers for Disease Control and Prevention, DHHS, July 1997. [Available at http://www.cdc.gov/niosh/pdfs/97-145.pdf]

National Sleep Foundation. NSF Statement Regarding New Hours of Service Rules for Truckers. News Archive 2003. Washington, DC, 2003. [Available at http://www.drowsydriving.org/press_room/news_stories/hosrules03.cfm]

National Sleep Foundation. Adolescent Sleep Needs and Patterns: research Report and Resource Guide. National Sleep Foundation, Washington, DC, 2000.

National Transportation Safety Board. "Ford Explorer Sport Collision With Ford Windstar Minivan and Jeep Grand Cherokee on Interstate 95/495 Near Largo, Maryland, February 1, 2002," Highway Accident Report NTSB/HAR-03/02. PB2003-916202 Notation 7561, National Transportation Safety Board, Washington, DC, 2003. {Available at http://www.ntsb.gov/publictn/2003/HAR0302.pdf]

National Transportation Safety Board. *Safety Study: Fatigue, Alcohol, Other Drugs, and Medical Factors in Fatal-to-the-Driver Heavy Truck Crashes*, Vol. 1, NTSB, Washington, D.C., 1990.

Nelson, T.F., N.E.Isaac and J.D. Graham. Development and Testing of Countermeasures for Fatigue-Related Highway Crashes, Harvard School of Public Health, Boston, MA, 2001. {Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/listening/toc.htm]

Pack, A.I., A.M. Pack, E. Rodgman, A. Cucchiara, D.F. Dinges and C. W. Schwab. "Characteristics of Crashes Attributed to the Driver Having Fallen Asleep," *Accident Analysis and Prevention*, Vol. 27, 1995, p.769-775.

Persaud, B.N., R.A. Retting and C. Lyon. *Crash Reductions Following Installation of Centerline Rumble Strips on Rural Two-Lane Roadways*, Insurance Institute for Highway Safety, Arlington, VA, 2003.

Royal, D. National Survey of Distracted and Drowsy Driving Attitudes and Behavior: 2002. Volume I: Findings Report, The Gallup Organization, Washington, DC, April 2003. [Available at http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/survey-distractive03/index.htm]

Strayer, D.L., F.A. Drews, and D.J.Crouch. "Fatal distraction? A Comparison of the Cell-phone Driver and the Drunk Driver. In D. V. McGehee, J. D. Lee, & M. Rizzo (Eds.) *Driving Assessment 2003: International Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design*. Published by the Public Policy Center, University of Iowa (pp. 25-30). [Available at http://www.psych.utah.edu/AppliedCognitionLab/DrivingAssessment2003.pdf]

Strayer, D.L. and W.A. Johnston. "Driven to Distraction: Dual-task Studies of Simulated Driving and Conversing on a Cellular Phone," *Psychological Science*, Vol. 12, 2001, p.462-466. [Available at http://www.psych.utah.edu/AppliedCognitionLab/PS-Reprint.pdf]

Stutts, J.C., J.W. Wilkins and B.V. Vaughn. Why Do People Have Drowsy Driving Crashes? Input from Drivers Who Just Did. Washington, D.C., AAA Foundation for Traffic Safety, November 1999. [Report available at www.aaafoundation.org]

Stutts, J.C. *Sleep Deprivation Countermeasures for Motorist Safety*. NCHRP Synthesis 287, Transportation Research Board, National Research Council, Washington, D.C., 2000.

Stutts, J.C., H.F. Huang and W.W. Hunter. Cell Phone Use While Driving in North Carolina: 2002 Update Report. University of North Carolina, Highway Safety Research Center, Chapel Hill, NC, 2002.

Stutts, J.C., D.W. Reinfurt, L. Staplin and E.A. Rodgman. *The Role of Driving Distraction in Traffic Crashes*, AAA Foundation for Traffic Safety, Washington, D.C., 2001. [Available http://www.aaafoundation.org]

Sundeen, M. *Cell Phones and Highway Safety. 2003 State Legislative Update*. National Conference of State Legislatures, Denver, CO, December 2003. [Available at http://www.ncsl.org/programs/esnr/cellphoneupdate1203.htm]

Tang, P. Personal communication, April 2003.

Vila, B. Tired Cops: The Importance of Managing Police Fatigue. Police Executive Research Forum, Washington, DC, 2000. [Information available at http://www.policeforum.org]

Wang, W.S. R.R. Knipling and M.J. Goodman. The Role of Driver Inattention in Crashes: New Statistics from the 1995 Crashworthiness Data System," 40th *Annual Proceedings,*

Association for the Advancement of Automotive Medicine, Vancouver, British Columbia, October 1996, p.377-392.

Wylie, C.D., T. Shultz, J.C. Miller, M.M. Mitler and R.R. Mackie. *Commercial Motor Vehicle Driver Fatigue and Alertness Study. Final Report* (Transport Canada Report TP 12875E) and *Technical Summary* (FHWA Report FHWA-MC-07-001), Essex Corporation, Goleta, CA, 1996.